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Cost Per Hour of Using Farm Machinery

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ONE of the biggest items in the cost of producing crops is that of equipment and power. A farmer must be able to analyze these costs and to predict future costs when selecting new equipment, if he is to keep them as low as possible for his particular situation. A good power and machinery program alone will not make a farmer who is poor with crops and livestock successful, but an unwise power and machinery program can bankrupt almost any farmer, no matter how good he is in other lines.

The present national situation, wherein the farmer is being asked to produce more with less labor than ever before, makes it even more important that farm equipment be used with maximum efficiency. Since the supply of new machinery will be limited, farmers who are badly in need of new machines should make plans as to what they will do in case they cannot buy what they need.

In general, there are two possibilities open to the farmer in such a position. One is to repair the old machine and get along with it as well as possible. The other is to rent a good machine from a neighbor who is not using it to capacity. It should be more economical of labor to rent a good machine, because it will give less mechanical trouble than the worn-out machine and, if of improved design, it will probably cover more acres per hour. Furthermore, if one good machine has sufficient capacity to do the work on two farms instead of one, the cost to both the owner and the renter should be considerably less than when each owns a good machine.

Total crop production costs are what count. Power and labor costs are just as important as machinery costs. Sometimes total costs can be reduced by increasing machinery costs. That is, a larger machine used fewer hours may reduce labor and power costs more than enough to compensate for the increase in machine cost. On the other hand, too large a unit will add costs faster than the saving in labor will decrease costs—thus the total cost becomes larger. Between these is an optimum balance or *low point.*

The exact effect is difficult to estimate, and the only sure method is to calculate the total cost of power, labor, and machinery for each of the machines under consideration. The farmer who will take the time and trouble to "figure it out" will find himself well repaid.

Method of Determining Cost of Operation

One thing that frequently prevents a cooperative arrangement is uncertainty as to what is a fair rental charge. The owner of the machine may not be sure that he is getting enough to compensate for the wear on the machine, and the renter may suspect that he is paying more than it would cost him to own a machine.

The method of calculating costs presented in this bulletin should give a basis for a fair rental charge according to the particular situation, as well as being of use in machinery cost accounting, and prediction of future costs.

In order to eliminate as much calculating as possible, the Table on pages 6 and 7 lists for each machine the cost per hour with varying amounts of use. In order to make this applicable to different sizes of the same types of machines, the cost is listed on the basis of each \$100 of new cost.

For example, a corn picker used 100 hours a year costs \$0.16 per hour per \$100 of new cost. In the case of a \$500 one-row corn picker, this would give \$0.80 per hour; a \$775 two-row corn picker would cost \$1.24 per hour. Let us take the case of a \$90 mower used 60 hours per year. The cost would be $\$0.90 \times 0.167$, or \$0.15 per hour.

An explanation of the basis for estimating depreciation and repair data and of the method of calculating costs starts on page 4.

COST CURVES FOR FARM IMPLEMENTS

Cost curves for some of the more common farm implements are shown on pages 8 and 9. Approximate current prices (1942) for good quality machines have been applied to the data in the Table on pages 6 and 7.

It may be noted from these curves that the cost per hour drops rapidly as the hours of use per year increase, until the hours of use per year are a little more than enough to wear the machine out before it becomes obsolete. Increased use per year beyond this does not greatly lower the cost per hour. If a farmer operating in the high cost section of the curve can arrange to double the use of his machine by a renting arrangement with a neighbor, he can usually get into the low cost section. Of course, this assumes that the machine has enough capacity to handle the extra work in the time available.

In the case of such a renting arrangement, the owner may feel that it is fair to charge a rental fee perhaps 30 per cent in excess of the calculated cost, in order to compensate for the responsibilities of ownership. This would still save the renter money over owning his own machine.

In the case of a machine which is several years old and rented out for the first time, a rental charge based on the hours of use that year would be much lower than the cost per hour to the owner throughout the preceding years. An equitable procedure might be to calculate costs on the basis of the owner's estimate of average use per year throughout the life of the machine.

Basis of Cost Figures

The safest guide to the depreciation and repairs to be expected for a particular machine is past experience with a large number of similar machines. Individual conditions have a great effect on the rate of wear, but, to be safe, one should not assume that he can make a machine last longer than the average.

Several states have made rather extensive studies of the depreciation and repairs for farm machinery. It has been generally agreed that farm machinery depreciates primarily through obsolescence, or becoming out of date, and the importance of depreciation due to wear has been minimized. However, the variations in results of studies made in different states cannot be explained unless depreciation due to wear is given an important place.

Depreciation Due to Wear

A striking example is the case of grain binders in Iowa and Indiana. In Iowa, for 210 binders, the average life estimated by owners was 16 years and the average use was 6 days per year. In Indiana, for 266 binders, the average life estimated by owners was 21.4 years and the average use was 4.5 days per year. In both states, the average total life of the binders was approximately 96 days or 1000 hours, and that is the basis for the estimate in the Table on pages 6 and 7 of 1000 hours as the total life of a grain binder until worn out.

Another fact which shows up in a comparison of machinery studies in the different states is the tie-up between length of life and total repair costs. Some machines had many more hours of life in Pennsylvania and Kentucky than in Iowa, and, in general, the total cost of repairs was much higher than in Iowa.

The estimates of "Hours to Wear Out" in the table on pages 6 and 7 is for the repair cost shown. Of course, with more repairs a machine can be made to run longer.

Depreciation Due to Obsolescence

Some of the estimates in the Table of "Years Until Obsolete" may seem low, as in the case of 20 years for a horse mower. There are many mowers more than 20 years old which are still in use. On the other hand, many mowers are discarded before they are 20 years old, even though they are not worn out. Another complication is the fact that a machine may be obsolete for a large farm on high-priced land, but still be suitable for a small farm in a poorer section. In general, it has been considered better that the estimates err on the low side than on the high, so that calculated costs will be too high rather than too low.

In some cases, the past is a very poor guide to the future and many of the estimates are based primarily on judgment. For instance, tractor mounted tools become obsolete with their tractor, regardless of their own age or qualifications, and 12 years has been used as the time until obsolete. In the case of corn pickers and combines, machines which are still changing rapidly, it is estimated that for safety the owner should calculate his costs on the basis of 10 years until obsolete.

It is easier to predict the rate of obsolescence due to improvements in existing machines than that due to the development of new methods and machines. For instance, combines have caused binders and threshers to become obsolete in many communities which did not dream of such a possibility 10 years ago.

It is recognized that these average data may not apply to a machine which varies from the average in quality of design and construction, and the owner can make corrected calculations for his particular machine if he so desires. Operating conditions are probably more important than machine quality, and where they are much more severe than average—due to rocks or heavy soil, for instance—appropriate corrections should be applied.

Although these data consist largely of estimates with considerable possibility of error, it will be found that a change of 25 per cent in the estimate of wear, obsolescence, or repairs will usually change the total cost per hour only 10 or 15 per cent.

Calculating the Depreciation Cost

Depreciation is the biggest single item in the cost of farm machinery. It is defined as the loss in value with the passing of time, and the rate of depreciation depends on the length of the useful life of the machine.

The length of the useful life of a machine depends upon

(1) *Mechanical deterioration or wear*, as affected by
- (a) Amount of use
- (b) Operating conditions
- (c) Care by operator as to lubrication, adjustment, repair, and shelter.

(2) *Obsolescence*, as affected by
- (a) Increased efficiency of new machines doing the same job
- (b) Development of new methods eliminating the job.

Depreciation, then, may take place through wear, obsolescence, or both. To calculate depreciation per hour through wear alone, we can divide the new cost by the total hours of service the machine will give before being worn out.

Much farm machinery, however, may not wear out but eventually becomes valueless through obsolescence. In this case, a depreciation cost based on the hours of use until worn out will be too low. A better method is to assume that the depreciation per year will be the first cost divided by the machine's years of life until

(Continued on page 10)

COST PER HOUR OF USING FARM MACHINERY (Per $100 of New Cost)

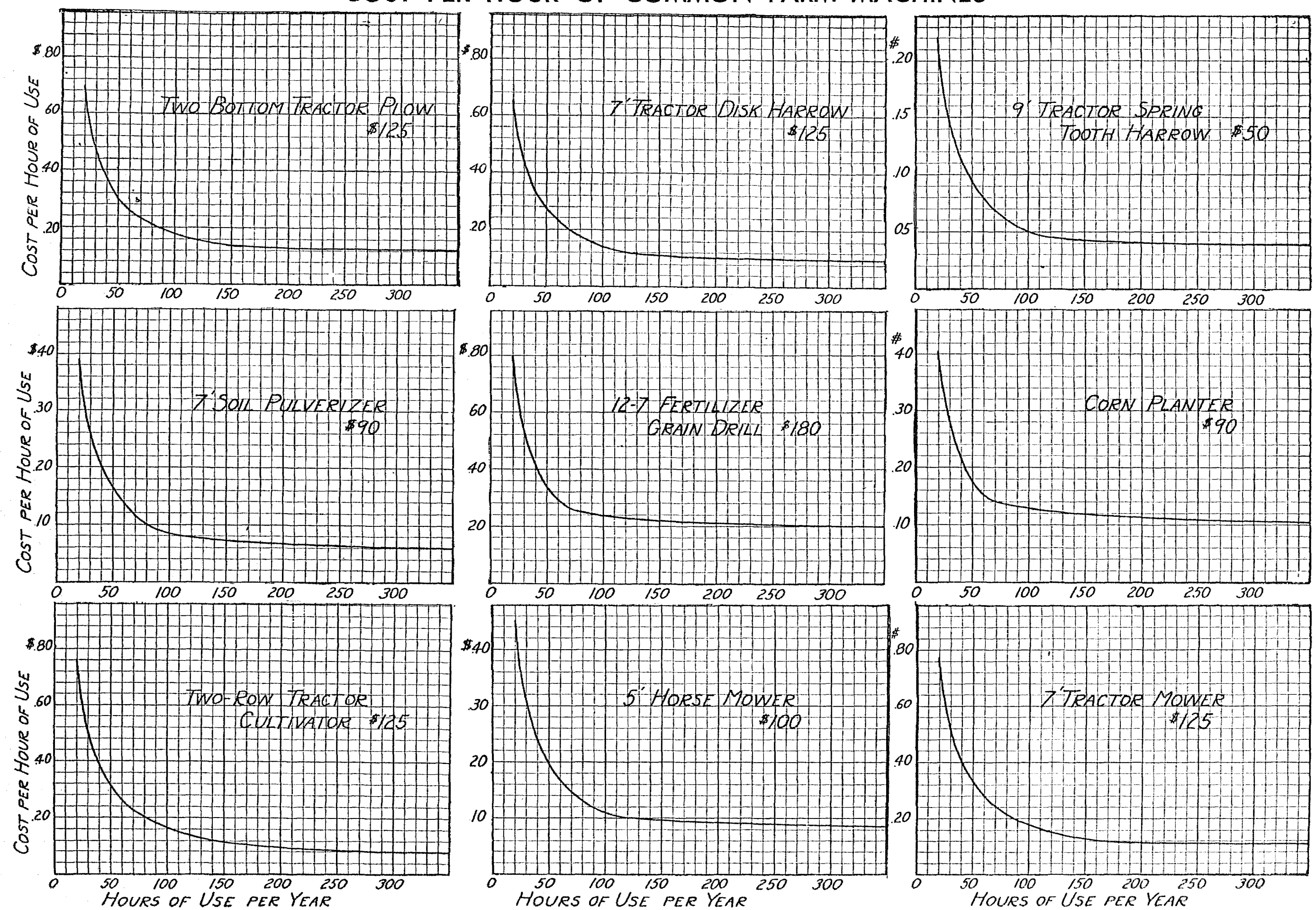
MACHINE	Years until Obsolete	Hours to Wear Out	Total Repair Cost in % New Cost	COST PER HOUR OF USE PER $100 OF NEW COST						
				20 hours per year	40 hours per year	60 hours per year	100 hours per year	150 hours per year	250 hours per year	350 hours per year
TILLAGE:										
Walking Plow..........	25	3000	200	$0.442	$0.255	$0.192	$0.135	$0.123	$0.114	$0.110
Riding Plow...........	20	2500	80	.457	.244	.174	.117	.095	.086	.082
Tractor Plow..........	15	2000	80	.550	.295	.210	.142	.113	.104	.100
Disk Harrow, Horse....	20	2500	30	.437	.225	.154	.097	.075	.066	.062
Disk Harrow, Tractor..	15	2000	30	.525	.270	.185	.117	.088	.079	.075
Spring Tooth Harrow..	20	2000	30	.440	.228	.157	.100	.088	.077	.075
Spike Tooth Harrow....	20	2500	30	.437	.225	.154	.097	.075	.066	.062
Roller................	25	1500	10	.382	.195	.132	.108	.096	.087	.083
Soil Pulverizer........	20	2000	15	.433	.220	.150	.093	.081	.072	.068
PLANTING:										
Endgate Seeder........	20	800	15	.444	.232	.199	.179	.167	.158	.154
Grain Drill............	20	1200	20	.442	.230	.159	.135	.123	.114	.110
Corn Planter..........	20	1200	30	.450	.238	.167	.143	.131	.122	.118
CULTIVATING:										
Rotary Hoe...........	15	1500	20	.523	.268	.183	.115	.103	.094	.090
Riding Cultivator......	20	3000	60	.445	.233	.162	.105	.077	.067	.063
Tractor Cultivator.....	12	2500	30	.602	.307	.209	.130	.091	.066	.062
HAY HARVESTING:										
Mower, Horse.........	20	2000	50	.450	.238	.167	.110	.098	.089	.085

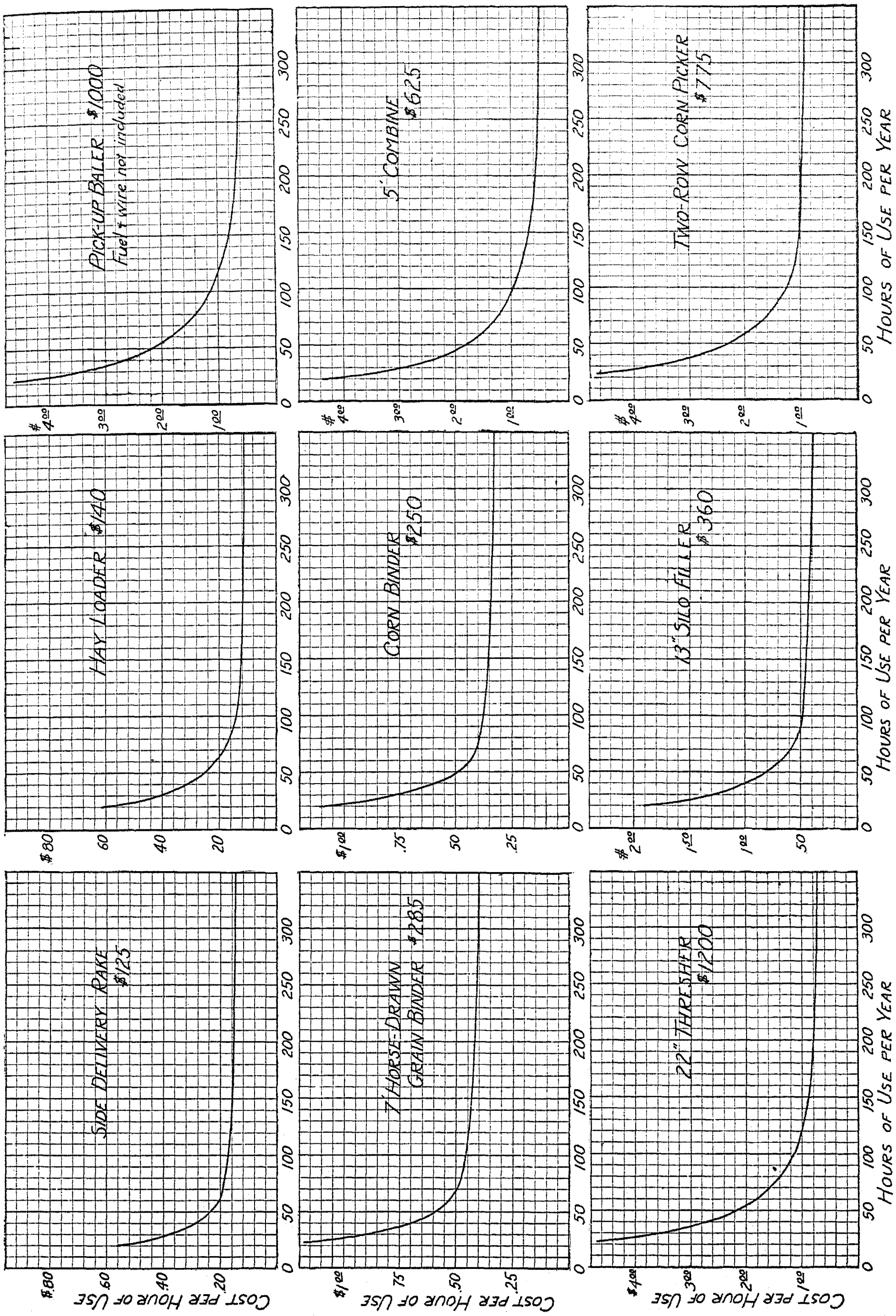
Tractor Cultivator.....	12	2500	30	.602	.307	.209	.130	.091	.066	.062
HAY HARVESTING:										
Mower, Horse..........	20	2000	50	.450	.238	.167	.110	.098	.089	.085
Mower, Tractor.........	12	2000	50	.615	.320	.222	.143	.104	.089	.085
Sulky Rake	25	1500	25	.372	.205	.142	.119	.107	.098	.094
Side Delivery Rake.....	20	1200	25	.446	.234	.163	.139	.127	.118	.114
Tractor Buck Rake.....	12	1500	25	.607	.312	.214	.135	.107	.098	.094
Hay Loader...........	20	1800	20	.436	.224	.153	.102	.09	.081	.077
Stationary Baler.......	20	4000	30	.433	.221	.150	.093	.064	.047	.043
Pick-up Baler*	15	3000	40	.523	.268	.183	.115	.081	.065	.057
GRAIN HARVESTING:										
Grain Binder..........	20	1000	30	.455	.243	.185	.165	.153	.144	.140
Thresher	20	2500	25	.435	.223	.152	.095	.073	.064	.060
Combine..............	10	2000	40	.695	.358	.245	.155	.110	.084	.080
CORN HARVESTING:										
Corn Binder...........	20	1000	20	.445	.235	.175	.155	.143	.134	.130
Silo Filler.............	15	1200	20	.527	.272	.187	.135	.123	.114	.110
Corn Picker...........	10	1200	30	.700	.363	.250	.160	.131	.122	.118
Husker-Shredder	15	2500	25	.520	.265	.180	.112	.078	.064	.060
				60 hours per year	150 hours per year	300 hours per year	500 hours per year	750 hours per year	1000 hrs per year	1500 hrs per year
MISCELLANEOUS:										
Manure Spreader... ..	15	4000	15	.174	.072	.041	.036	.034	.033	.031
Wagon	25	20000	15	.128	.053	.020	.018	.013	.011	.010
Hay Rack.............	25	8000	20	.128	.053	.027	.022	.020	.018	.017
Tractor†.............	15	7500	35	.175	.073	.030	.025	.023	.022	.020

*fuel and wire not included.

† Fuel and lubricant not included

COST PER HOUR OF COMMON FARM MACHINES




PICK-UP BALER $1000
Fuel & wire not included
5' COMBINE $625
TWO-ROW CORN PICKER $775
HAY LOADER $140
CORN BINDER $250
13" SILO FILLER $360
SIDE DELIVERY RAKE $125
7' HORSE-DRAWN GRAIN BINDER $285
22" THRESHER $1200
HOURS OF USE PER YEAR
COST PER HOUR OF USE

obsolete, the cost per hour being the cost per year divided by the hours of use per year.

Most farm machinery depreciation must be calculated on the obsolescence basis, but the large farmer, custom operator, or farmer who rents out his machines may be misled by fictitiously low costs secured by this method. Therefore, one must consider the yearly hours of use of the machine and see if it will be worn out or become obsolete first.

As an example, let us calculate the depreciation charge per hour for a \$100 mower which is used 80 hours per year. From the Table, we see that the average life of a mower until worn out is 2000 hours and it is estimated that a new mower will be obsolete in 20 years. In 20 years this mower will have been used only 1600 hours. So, it will become obsolete rather than worn out.

Cost per hour of depreciation through obsolescence.

$$= \frac{\text{New cost}}{\text{Estimated years until obsolete} \times \text{Annual hours of use}}$$

$$= \frac{100}{20 \times 80} = \$0.0625$$

If a similar mower is used 150 hours per year, it will be worn out before 20 years have passed.

Cost per hour of depreciation through wear

$$= \frac{\text{New cost}}{\text{Total hours of service until worn out}}$$

$$= \frac{100}{2000} = \$0.05$$

Repair Cost

It is logical to consider that the repair cost will vary with the amount of use. That is, a machine which is used twice as many hours per year as another will need twice the repairs. A uniform hourly charge for repairs can be secured by dividing the estimated total cost of repairs until the machine is worn out by the hours of service until it is worn out.

For example: our \$100 mower, which will have a life of 2000 hours, will have a total repair cost equal to 50 per cent of the new cost, according to the Table (see pages 6 and 7).

$$\text{Cost per hour of repairs} = \frac{\text{Total cost of repairs}}{\text{Total hours of service until worn out}}$$

$$= \frac{.50 \times 100}{2000} = \$0.025$$

Interest, Housing, Taxes, and Insurance

The charge for interest represents the interest that should have been received from the value of the machine if that money was invested in stocks, bonds, etc. This is a yearly charge and is not affected by the amount of use. Four per cent is usually considered a fair rate in Ohio. So, the yearly interest charge throughout the life of the machine is 4 per cent of the average value, the average value being taken as one-half the new cost.

The charge for housing is also independent of use and is usually taken as 1 per cent of the average value. This assumes that the space occupied by the machine is proportional to the new cost.

Taxes are independent of use, and a rate of 1.6 per cent of the average value has been used.

Insurance is independent of use, and runs about 0.4 per cent of the average value.

Since the yearly costs of interest, housing, taxes, and insurance are independent of use and can be expressed as a percentage of the average value, we can combine them. This gives a yearly cost of 7 per cent of the average cost or 3½ per cent of the new cost.

For our $100 mower, used 80 hours per year:

Cost per hour for interest, housing, taxes, and insurance

$$= \frac{.035 \times \text{New cost}}{\text{Annual hours of use}}$$

$$= \frac{.035 \times 100}{80} = \$0.0438$$

For a similar mower used 150 hours per year:

Cost per hour for interest, housing, taxes, and insurance

$$= \frac{.035 \times 100}{150} = \$0.0233$$

Totaling the Costs

The total cost per hour will be the sum of the above items.

For the mower which was used 80 hours per year:

Total cost per hour $= .0625 + .025 + .0438 = \$0.1313$

For the mower which was used 150 hours per year:

Total cost per hour $= .05 + .025 + .0233 = \$0.0983$

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